AFTER MID EXAM

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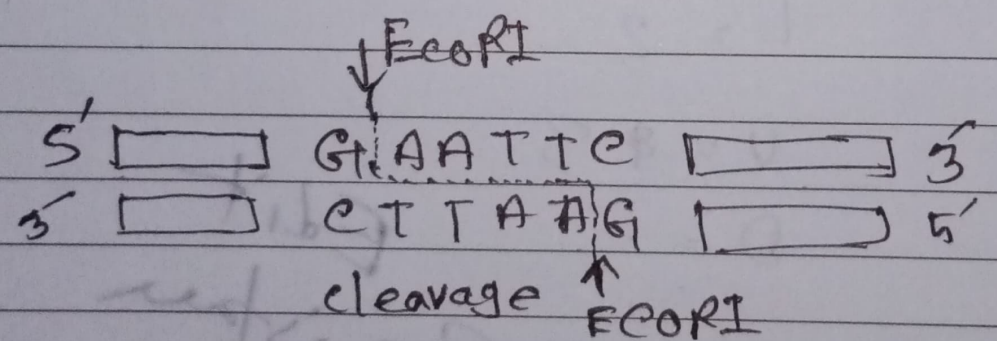
18.10.22 @Bio-Informatics

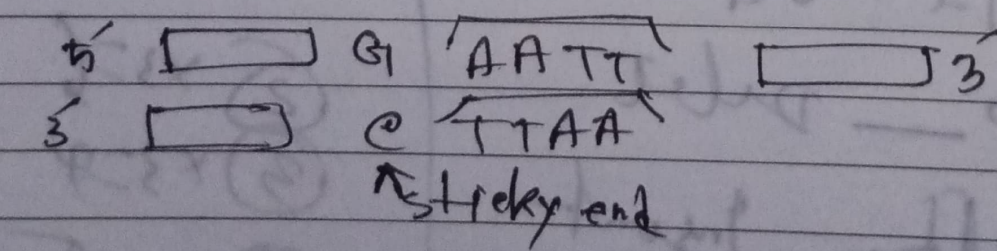
#Restriction Enzyme/Molecular Scissors

→ Restriction enzyme is a protien isolated from bacteria that cleaves DNA seavences at seavence-specific sites, producing DNA fragments with a known sequence at each end.

Example:

Eco RI, Bam HI, Bgl II, Mae II, HindII





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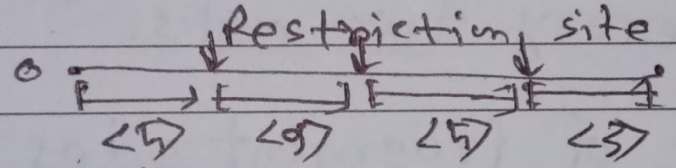
Restriction Map :→ A map showing positions of restriction sites in a DNA sequence.

∞ If DNA seavenee is known then construction of restriction map is a trival exereise.

1. Full/complete restriction digest
2. Partial restriction digest



Gel Electrophoresis technique: It is a technique to measure the distance between two individual restriction sites correspond to the length of the restriction fragment between ~~two~~ those two sites.

Full Restriction Digest

Cutting DNA at each restriction site creates multiple restriction fragments

∞ It is a consequantive proeen to find positins of restriction sites

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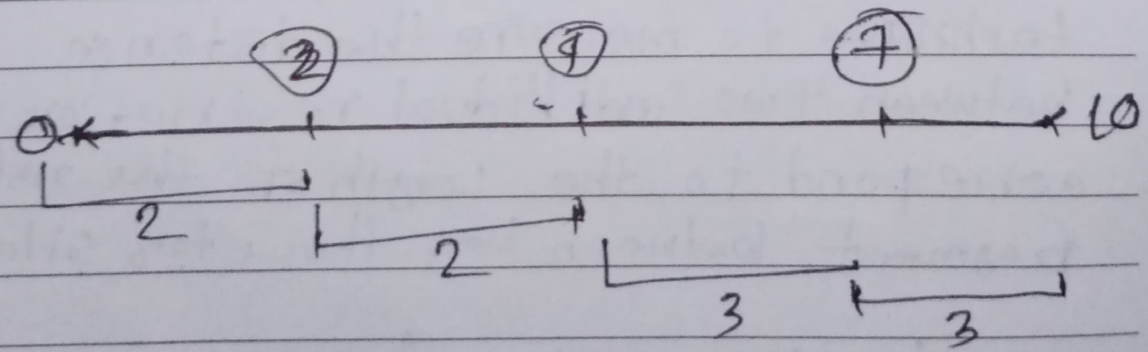
Partial Restriction Digest:

- The sample of DNA is exposed to restriction enzyme for only a limited amount of time to prevent it from being cut at all restriction sites.

- This experiments generates the set of all possible restriction fragments between every two cuts.

- This set of fragment sites are used to determine the positions of restriction sites in the DNA sequence.



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Partial Digest Problem (PDP)

X : the set of n integers representing the location of all cuts in the restriction map, including the start and end

n : total number of cut

ΔX : the multiset of integers representing lengths of each of the fragments produced from a partial digest

Goal : Given all pairwise distances between points on a line, reconstruct the positions of those points.

Input : The multiset of pairwise distance, L, containing $n(n-1)/2$ integers.

output : A set of X, of n integers such that $\Delta X = L$.

Algorithm

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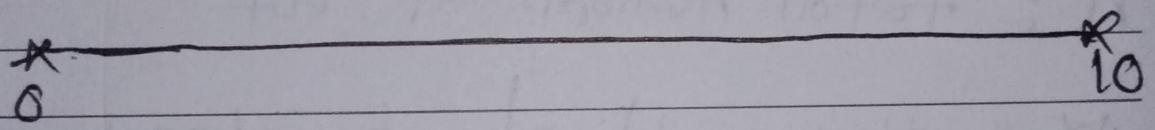
^ Brute force
^ Divide & conquer

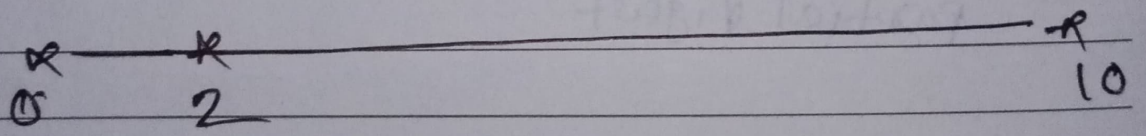
PDP-1

$\Delta X = L = \{2, 2, 3, 3, 4, 5, 6, 7, 8, 10\}$

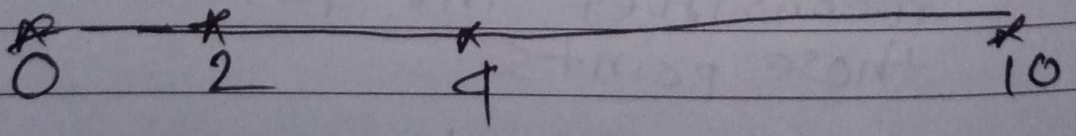
$X = \{?\}$



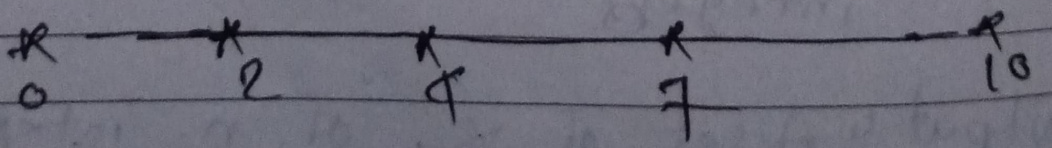
$L = \{2, 2, 3, 3, 4, 5, 6, 7, 8\}$



$L = \{2, 3, 3, 4, 5, 6, 7\}$



$L = \{3, 3, 5\}$



$L = \{\}$

$X = \{0, 2, 4, 7, 10\}$

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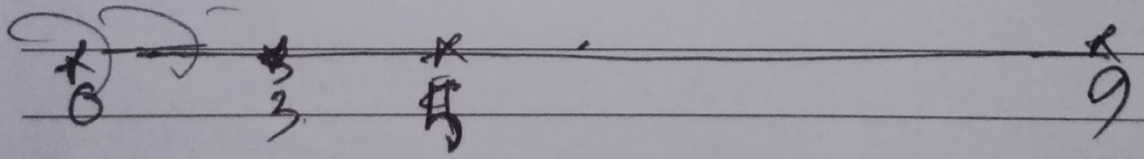
PDP #2

PDP Table form:

X |	0	2	4	7	10
0		2	4	7	10
2			2	5	8
4				3	6
7					3
10					

} $\Delta x = L$

$\Delta x \geq L = \{2, 3, 4, 5, 6, 9\}$



$x = \{0, 3, 5, 9\}$ Ans

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DDP Tabular form:

x	0	3	5	9
0		3	5	9
3			2	6
5				4
9				

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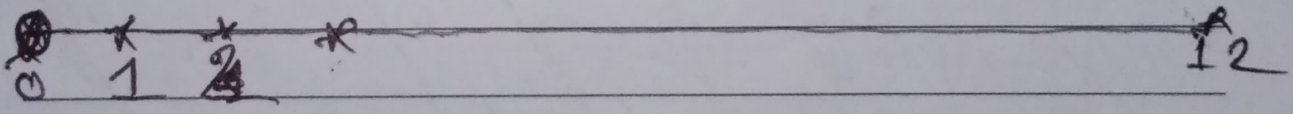
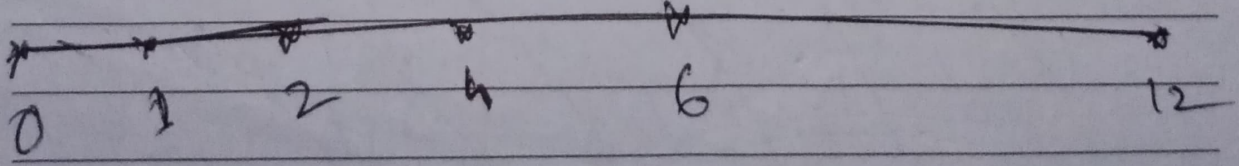
Apply partial Digest algorithm to find the restriction sites in the restriction map complaint with the following DNA ~~sequence~~ fragments.

$\Delta x = \{1, 1, 2, 2, 2, 3, 3, 4, 4, 5, 5, 5, 6$

$7, 7, 7, 8, 9, 10, 11, 12\}$





{1,1,2,2,3,3,4,4,5,5,5,6,7,7,7,8,9,10,11,12}

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0 1 3 12

Ax = {1,1,2,2,2,3,3,4,4,5,5,6,7,7,7,8,9,10,11,12}

0 1 2 5 7 9 12

X2 = {0,1,2,5,7,9} X2 = {0,1,5,7,8,10,12}

10.10.22

PDP has multiple solutions. Date Page
no need to worry.

. . . .

Homometric Set (same)

$$[[x_1 = x_2] = \Delta x \; 2L]$$

Example:

$$x_1 = \{0, 1, 2, 5, 7, 9, 12\}$$
$$x_2 = \{0, 1, 5, 7, 8, 10, 12\}$$

(x_1)

	0	1	2	5	7	9	12
0		1	2	5	7	9	12
1			1	4	6	8	11
2				3	5	7	10
5					2	4	7
7						2	5
9							3
12							

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x_2

	0	1	5	7	8	10	12
0	.	1	5	7	8	10	12
1			4	6	7	9	11
5				2	3	5	7
7					1	3	5
8						2	4
10							2
12							

check whether following two restriction sit homomorphic or not.

$x_1 = \{0, 1, 3, 8, 9, 11, 12, 13, 15\}$

$x_2 = \{0, 3, 9, 5, 7, 12, 13, 15\}$

x_1	0	1	3	8	9	11	12	13	15
0		1	3	8	9	11	12	13	15
1			2	7	8	10	11	12	14
3				5	6	8	9	10	12
8					1	3	4	5	7
9						2	3	4	6
11							1	2	4
12								1	3
13									2
15									

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(x2)	0	1	3	4	5	7	12	13	15
0		1	3	4	5	7	12	13	15
1			2	3	4	6	11	12	14
3				1	2	4	9	10	12
4					1	3	8	9	11
5						2	7	8	10
7							5	6	8
12								1	3
13									2
15									

$x = \{1,1,1,1, 2,2,2,2, 3,3,3,3, 4,4,5,5, 6,6, 7,7, 8,8,8, 9,9, 10,10, 11,11, 12,12,12, 13, 14, 15\}$

$x(x_1 = x_2)$

Yes, it is a monomorphic